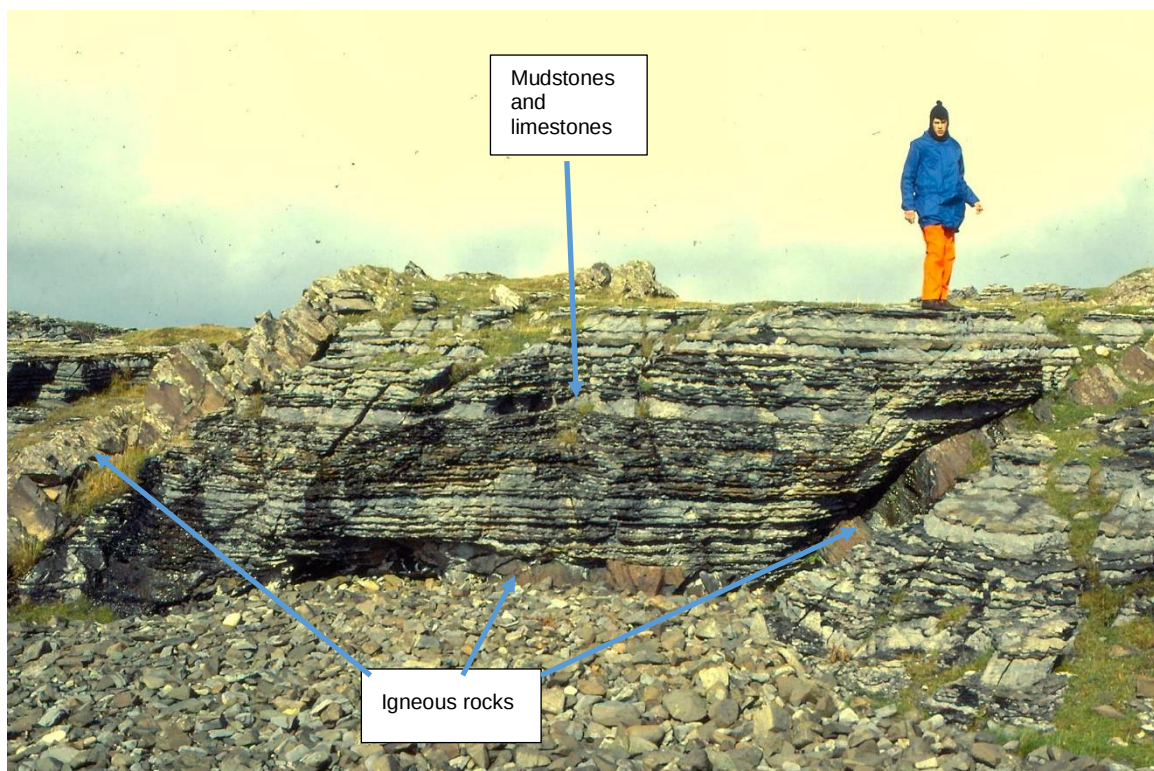


Some classic Scottish geology revealed
How good are you at establishing a geological history from photographs?

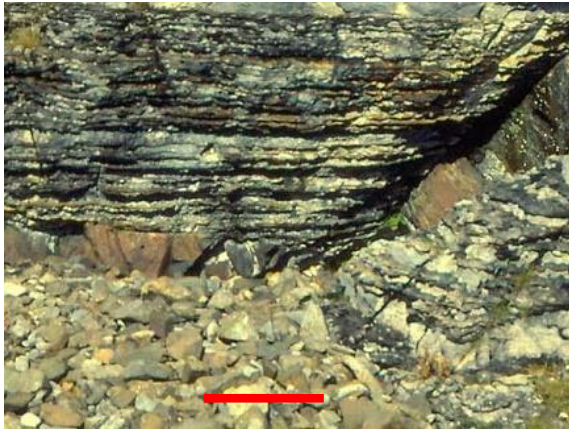
The photographs below show a small section of the coast of the Ardnamurchan Peninsula on the West coast of Scotland.



General view of the coastal section, showing tilted mudstones and limestones, looking East



The cliff section, looking North. The student is about 180cm tall



Close-up of the eastern end of the cliff section (Scale = 50cm)



Close-up of the western end of the cliff section (Scale = 50cm)

Ask pupils to examine the photos and to work out a possible geological history of this area, starting from the earliest event and working to the latest. They need to be aware of alternative interpretations where evidence is not clear cut. Pupils should be encouraged to use appropriate applications of the main principles of stratigraphy, i.e.

Principle of Superposition of Strata

Principle of Original Horizontality

Principle of Lateral Continuity

Law of Cross-Cutting Relationships

Law of Included Fragments

Pupils should be told that the layered rocks are mudstones and limestones with fossils, which point to a Jurassic age. The more massive brown-weathering rocks are igneous rocks of basaltic composition. Pupils could be encouraged to make scaled diagrams of some of the features, to help them focus on the detail.

Pupils should suggest:

- where there is doubt about establishing an age sequence,
- the field observations which they would make if they could visit the exposure, to try to resolve such issues.

The back up

Title: Some classic Scottish geology revealed

Subtitle: How good are you at establishing a geological history from photographs?

Topic: Pupils are asked to examine photographic evidence to establish a geological history of a small area, and to assess the reliability of their conclusions.

Age range of pupils: 16 years and above

Time needed to complete activity: 30 minutes

Pupil learning outcomes: Pupils can:

- apply the main principles of geology to a novel situation;
- interpret geological evidence from photographs;
- explain the problems of using photographic information alone to form firm conclusions about the geology.

Context: This activity could be used as a revision exercise after a general course in rocks and structures, or in preparation for fieldwork. One suggested geological history which might be drawn from the photos:

- deposition of a variable sequence of mud and carbonates;
- lithification and uplift of the sequence of mudstones and limestones;
- tilting of the sequence, with an apparent dip towards the South;

- fracturing of the sequence, with notable joints with an apparent steep dip towards the West;
- injection of a basaltic sill, apparently along a bedding plane in the sedimentary rocks;
- injection of two basaltic dykes, parallel to the westerly-dipping fracture pattern;
- uplift and erosion, to expose the sequence;
- marine erosion, leading to the formation of a cliff with a beach in front of it;
- a possible relative change in sea level, indicated by the generally flat surface on which the student is standing.

There are alternative interpretations which could include:

- The horizontal brown-weathering rock could be a lava flow and not a sill (resolved by looking for the presence of included fragments of it in the overlying sediments, and for the absence of a chilled margin above it).
- One or both dykes might predate the sill/lava flow (resolved by searching for cross-cutting relationships between the different units, which might involve some excavation of the beach debris).
- The sill and the dykes formed at the same time.

Following up the activity: Use the

Earthlearningidea activity below for a made-up geological section, either before or after the Ardnamurchan story.

https://www.earthlearningidea.com/PDF/40_What_is_the_geological_history.pdf

- Note: When followed across the peninsula, the steeply- inclined dykes are seen to be cone-sheets and not part of a linear dyke swarm. They are part of the North Atlantic Tertiary Igneous Province

Underlying principles:

- Application of the principles of geology is the fundamental method used by geoscientists to sequence rocks and rock events.

Thinking skill development:

- The principles of geology are patterns applied to sequences (construction)
- How the principles should (and should not) be applied causes cognitive conflict

- Discussion of the application of the principles involves metacognition and bridging to the case in hand.

Resource list: Enlarged photographs from pages 1 and 2.

Useful links: A British Geological Survey map of the Ardnamurchan area may be viewed at [BGS Geology Viewer \(BETA\)](#) and scrolling to Grid Reference 1490 7628 (NM490 628). Hovering the cursor brings up names of the main rock formations.

Source: Written by Peter Kennett of the Earthlearningidea team. Photos by Peter Kennett.

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